2. Connective Tissue

(2\textsuperscript{nd} primary tissue type)

- Found everywhere in the body; but the amount varies greatly
- Includes the most abundant and widely distributed tissues
Connective Tissue cont.

- Main subgroups/types
  1. Bone
  2. Hyaline Cartilage
  3. Dense Fibrous
  4. Areolar
  5. Adipose
  6. Blood
2 Connective Tissue Characteristics

I. Vascular (varies with type)

- Cartilage is avascular
- Dense connective tissue is poorly vascularized
- Other types—rich blood supply
2 Connective Tissue Characteristics

2. Extracellular Matrix

- What is matrix?
  - Nonliving ground substance: (fluid to hard) & fibers (collagen, elastic, or reticular)

- Why is matrix important?
  - Matrix is what enables connective tissue to bear weight, withstand great tension, & endure abuses such as physical trauma or abrasion
Major functions are

1. Protection—bone, cartilage, & fat
2. Support—bone & cartilage
3. Binding—connective tissue
4. Transportation—blood
5. Insulation—fat
3 Main Components of Connective Tissue

1. Ground substance
2. Fibers
3. Cells
3 Structural Elements of Connective Tissue

1. **Ground Substance** *(found in matrix)*

- Amorphous (unstructured) material that fills the space
- Made of interstitial fluid
- Functions as molecular “sieve” or medium thru which nutrients & other substances can diffuse b/w blood & cells
3 Structural Elements of Connective Tissue

2. Fibers: 3 types of fibers

A. Collagen (glistens white)
   - Extremely tough & provides tensile strength

B. Elastin (yellow)
   - Coiled structure can stretch & recoil like a rubber band
   - Provides elasticity (skin, lungs, & blood vessel walls)

C. Reticular
   - Fine collagen fibers, netlike
   - Constructs fine mesh around small blood vessels, support soft tissue of organs.
3 Structural Elements of Connective Tissue

3. Cells

- **Primary cell types are:**
  1. Bone → osteoblast
  2. Cartilage → chondroblast
  3. Connective tissue proper → fibroblast
  4. Blood → hemocytoblast (always actively mitotic)

- **Each cell type exists in immature & mature forms**
  - These cells are actively mitotic when immature & less active when mature

  “—blast” = immature cell  “—cyte” = mature cell
Connective Tissue Types

1. Bone (osseous)

- Protect and supports the body
- Fat storage
- Synthesis of blood cells

*Composed of:*

- **Osteoblast** cells in lacunae (cavities)
- Hard matrix of calcium salts (bone salts)
- Large numbers of collagen fibers

b/c of these 2, bone matrix is harder & more rigid than cartilage matrix
BONE

- Osseous tissue
  - Compact Bone has a hard matrix made of calcium salts
Compact Bone
SPONGY BONE

- Growing Bone
- RBC formation
Check…

- What are the three components of all connective tissue?
- What is the Matrix made of?
- What are the mature cells of bone and cartilage called?
Connective Tissue
Type 2. Cartilage

Hyaline cartilage

- Supports & reinforces
- Resilient cushioning properties
- Resists compressive stress
- Active growing regions near the end of long bones
- Found in larynx, ribs, end of long bones
- Chondrocytes and collagen
Hyaline Cartilage

- Found in larynx, attached ribs to breastbone, ends of bones (joints)
- Hard and Durable
Hyaline Cartilage

Hyaline cartilage 400x

Chondrocyte

Ground substance

Lacuna
Connective Tissue Types
Type: 3. Dense Fibrous

- Main matrix element is **collagen** fibers
- Cells are **fibroblasts**
- Examples:
  - Tendon – attach muscle to bone
  - Ligaments – attach bone to bone
Dense Fibrous Tissue

- **Tendons**
  - Attach muscles to skeletal bones

- **Ligaments**
  - Attach bones to bones
Dense Fibrous Tissue
Connective Tissue Types

Type 4. Areolar

- Most widely distributed connective tissue
- Soft, pliable tissue
- Contains all fiber types
- Can soak up excess fluid
- Wraps organs & holds them in position
Areolar Tissue

- Connective Tissue Glue
Areolar Tissue
Loose Connective Tissue
Type 5. Adipose

- an areolar tissue in which fat cells predominate

- Functions:
  - Insulates the body
  - Protects some organs
  - Serves as a site of fuel storage—ex. hips and breasts serve as fat “depots”
Adipose Tissue

- Fat, areolar tissue where fat cell predominate
Adipose Tissue
Connective Tissue Types—

5. Blood

• Most atypical connective tissue

• Consists of blood cells, hemocytoblast, and nonliving fluid matrix and fibers visible when clotting

• Functions --transport vehicle for materials for CV system, carries nutrients, wastes, respiratory gases, & other substances
Blood

- Hemocytoblasts
- Matrix
- Fibers (clotting)
Blood Tissue

erythrocytes

leukocytes
3. Nervous Tissue

(3rd primary tissue type)

- Found in brain, spinal cord, & nerves
- Regulates & controls body functions
- Highly specialized branching Neuron cells generate & conduct nerve impulse
- Cytoplasmic extensions allow electrical impulses to transmit over large w/in the body
Nervous Tissue
Nervous Tissue
4. **Muscle Tissue**  
(4\textsuperscript{th} primary tissue type)

- Function is to produce body movements
- Highly cellular, well-vascularized tissues
- Muscle cells are composed of myofilaments
  - 2 types of myofilaments:
    1. Actin
    2. Myosin

  Work together to bring about contraction of muscles
3 Types Muscle Tissue

1. **Skeletal Muscle**
   - Form the flesh of the body
   - Pull (contract) on bones or causing body movements
   - Controlled voluntarily
   - Cells- long, cylindrical, and **striated or banded**
   - Cells have many nuclei (**multinucleated**)
MUSCLE

- SKELETAL
  - Voluntary
  - Striations
Skeletal Muscle
2. **Cardiac muscle**

- Function is to pump blood (involuntary) thru vessels to rest of body
- Found only in the heart wall
- Cells are **striated**, like skeletal, but there are structural differences:
  - Branching cells fit together tightly at unique junctions called intercalated disks
  - One nucleus per cell (**uninucleate**)
Cardiac Muscle

- Involuntary
- Striations
- Intercalated Disks
Cardiac Muscle
3 Types Muscle Tissue

3. **Smooth muscle**

- No visible striations
- Involuntary muscle
- Individual cells are spindle shaped & contain **one** centrally located nucleus
- Found in walls of hollow organs (except heart); digestive & urinary tract organs, uterus, & blood vessels
- Functions to squeeze substances thru organs by alternately contracting & relaxing (peristalsis)
Smooth Muscle

- Involuntary
Smooth Muscle